No. 1128.] THE [Price 3d.

Mechanics' Magazine,

MUSEUM,

REGISTER, JOURNAL, AND GAZETTE.

SATURDAY, MARCH 22, 1845.

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NOTICES TO CORRESPONDENTS.

The Supplement to our last Volume will be published next week.

A Calculator.—No public rewards have been offered for any of the seven objects mentioned.

Communications received from G. Z.—A Watchmaker—C. W.—A Subscriber and Contributor—W. D. R.—An Emigrant.

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THE RAILWAY RECORD,

Edited by Mr. John Robertson, (late Editor of the *Railway Times*,) published every Saturday morning, in time for the early mails. Price 6*d.* stamped. Office, 153, Fleet-street.

Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 1128.] SATURDAY, MARCH 22, 1845. [Price 3*d.*

Edited by J. C. Robertson, No. 166, Fleet-street.

MR. HAYS'S PATENT IMPROVEMENTS IN PROPELLING—DIFFERENTIAL GEARING, AND DIFFERENTIAL STERN PROPELLERS.

Fig. 1.

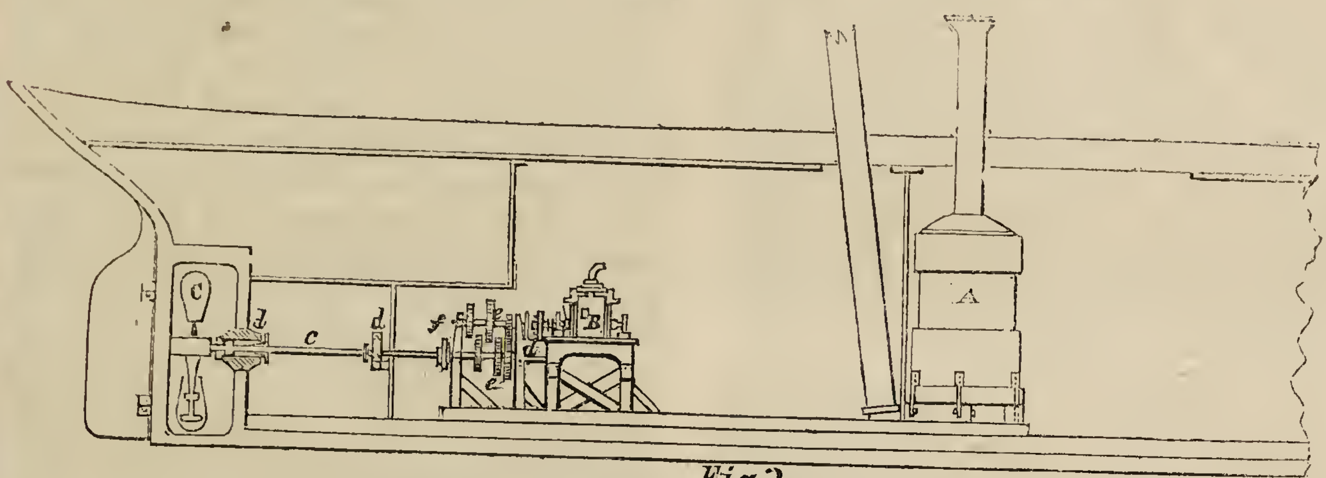
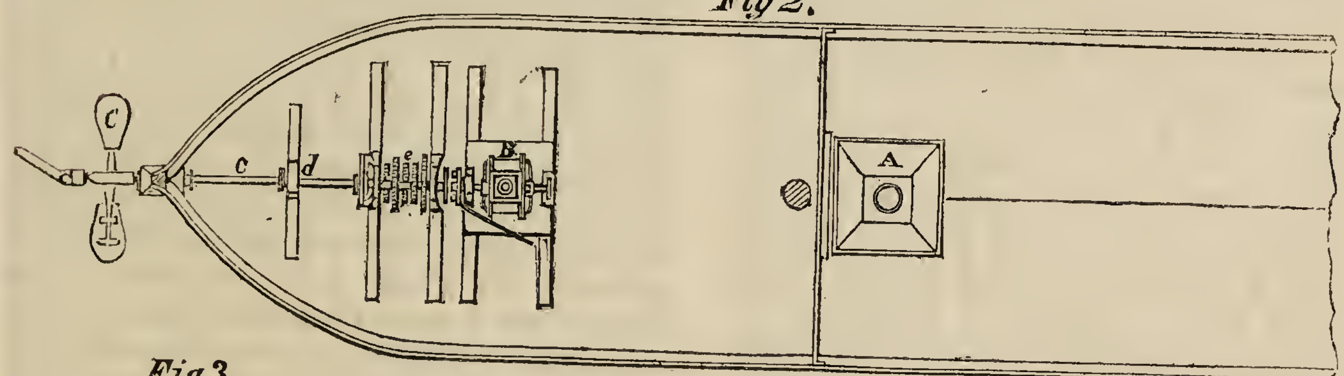


Fig 2.



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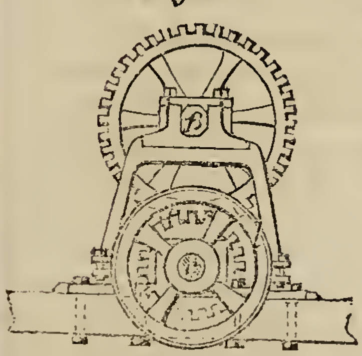


Fig 7.

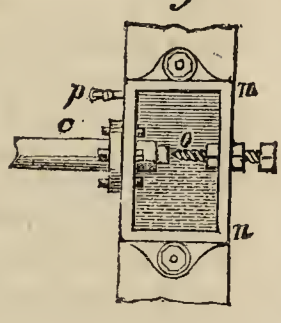


Fig 5.

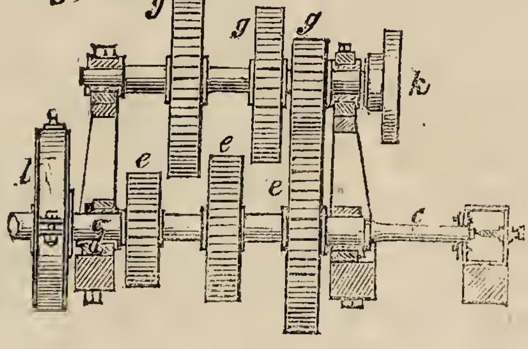


Fig. 4.

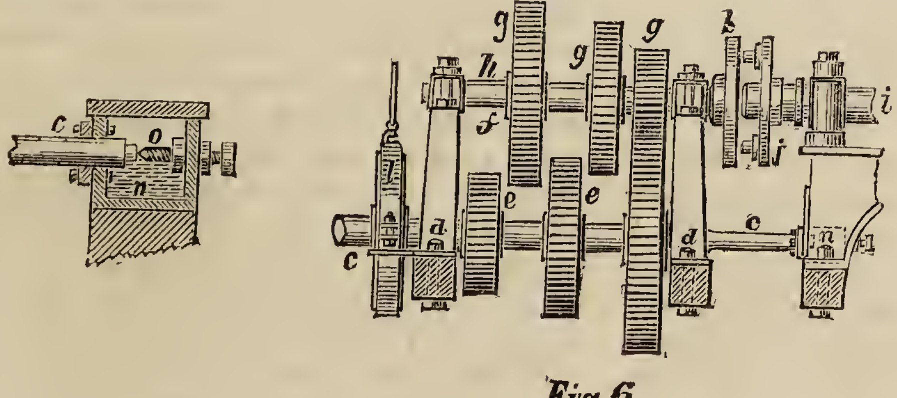


Fig. 9.

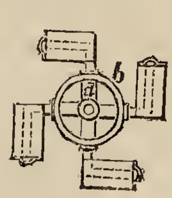


Fig. 10.

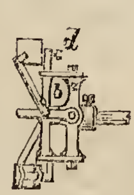
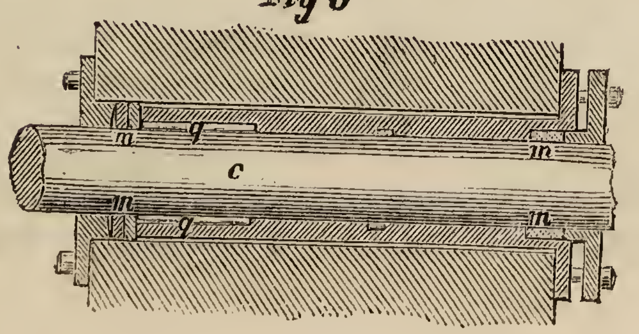


Fig 6



MR. HAYS'S PATENT IMPROVEMENTS IN PROPELLING—DIFFERENTIAL GEARING AND DIFFERENTIAL STERN PROPELLERS.

[Patent dated July 3, 1844; Specification enrolled January 2, 1845. Patentee, Christopher Dunkin Hays, of Bermondsey, Wharfinger.]

Mr. Hays's improvements* consist, *first*, in "a novel mode of transferring the motive power of the engine to the propeller, whereby the latter may be driven at different speeds according to circumstances, and without the necessity for altering the speed of the engine." *Second*, in an "improved mode of constructing certain of the working parts, whereby the friction thereof is considerably reduced;" and, *third*, in "a novel construction of propeller."

1. According to the present mode of employing steam as an auxiliary power in propelling sailing vessels, the engines and propeller are only brought into use occasionally, and under certain circumstances, such as during calms and light winds, but when favourable or strong winds prevail, the propeller and engine are thrown entirely out of use, and become so much dead and useless weight in the ship. Instead of following this plan, Mr. Hays proposes to make use of the auxiliary steam power continually, and under all circumstances, where it can be of the slightest use. With this view he employs such an engine and propeller as will be capable of propelling a vessel unaided by any other power, at a moderate rate of, say four or five knots per hour, during calms and very light winds, and by the adoption and employment of the differential gearing to be afterwards described, which he connects to the engine and propeller shaft, he hopes to be enabled at all times to propel the vessel four or five knots per hour, or nearly so, beyond the speed that she would go if unaided by his apparatus.

"For example," says Mr. Hays, "suppose that the engine will propel the vessel at the rate of four or five knots per hour in a dead calm, if a light wind capable of propelling her two knots per hour, without other assistance, should arise, then by the additional power of an engine and propeller with my apparatus adapted thereto, I shall by the two powers combined, be enabled to propel the vessel, say about six or seven knots per hour, and if the wind should increase so as (unaided) to propel the vessel four or five knots, then by the additional power of the engine she will proceed at the rate of eight or nine knots per hour, or nearly so, and so on according to the wind. * * * * * In order fully to understand this point, it will be necessary to examine what would be the effect of the ordinary auxiliary steam power upon the progress of a ship. Suppose this auxiliary power is calculated to propel the vessel four knots per hour unaided by any other power, and to effect this object the propeller is obliged to make sixty revolutions per minute—now if a wind springs up which, unaided, is also capable of propelling the vessel at the same or a greater speed than the engine is calculated for, it follows that although the propeller may still revolve sixty times per minute, still there is no (or at any rate very little) increased speed imparted to the ship, and the propeller is revolving uselessly, as the passage of the ship through the water would of itself drive the propeller at nearly the same speed if the latter were detached from the engine. The method I adopt in making the propeller available under these circumstances, is to drive it at a speed greater than that which the progress of the ship itself would give the propeller in its progress through the water—that is to say, if the speed of the ship sailing four knots per hour, is such as would cause the propeller to revolve sixty times per minute, if detached from the engine, it is clear that it will be necessary for the engine to drive the propeller an additional sixty, making one hundred and twenty revolutions in all, in order to propel the vessel about eight knots per hour. It will be understood that the engine is not required to exert any increased power to obtain this increased speed, as the ship's motion drives the propeller one sixty, and the engine the other sixty revolutions; the wind, therefore, by means of the motion of the ship through the water, assists in driving the propeller, and the engine gives it an additional impetus. If the vessel is propelled by the wind at the rate of six knots, a further increase, equivalent to an additional four knots, must be made in the speed of the propeller before the full benefit is obtained from the power of the engine, and so on according to the increased power of the wind."

The accompanying engravings show the method which Mr. Hays adopts. Fig. 1 represents a longitudinal vertical sec-

* For previous notice of these improvements see letter of Mr. Hays in our journal of the 11th of January last.

tion, taken through a vessel fitted with his improved auxiliary steam power. Fig. 2 is a plan of the same.

A A is the boiler and furnace, and B B one of Beale's patent improved rotary engines, (any other engine or motive power may be employed, this engine being merely selected for the purpose of illustrating the invention,) C is an ordinary propeller with any number of blades which may be considered most advisable. *c c* is the propeller shaft, on the inner end of which is the differential gearing *e e e*, shown on an enlarged scale in figures 3, 4, and 5. Another shaft, *f f*, furnished with a feather, *h h*, is mounted in bearings immediately above the inner end of the propeller shaft, and also carries toothed wheels, *g g g*, of different diameters, which wheels are mounted on and made to slide easily along the shaft *f f*. When it is required to change the speed of the propeller, the feather *h*, of the shaft *f*, passes through and looses all the wheels, *g g g*, and of course carries them round with it. The shaft of the engine is seen at *i*, and carries at its end a clutch, *j*, which, when brought into contact with the clutch box *k*, on the inner end of the shaft *f*, causes the latter with its wheels, *g g g*, to be carried round and drive the propeller shaft.

It will be observed, by referring to the figures, that the slowest motion is represented as in gear, as would be the case in calms or very light winds, when the whole power of the engine only, rather than the speed of the propeller is required. If a breeze were to spring up, then it would be necessary to increase the speed of the propeller. To effect this the engine must be temporarily detached by loosing the clutch: the second pair of wheels must then be put in gear, and the first put out of gear; then, upon connecting the engine again, the speed of the propeller will be very much increased. If the breeze should freshen still more, the engine must be again detached, and the third pair of wheels put in gear, the others being previously put out of gear; as the wheels, *g g g*, all slide freely along the shaft this object is easily effected by the attendant engineer. A friction brake *l*, of the ordinary kind, is mounted on the propeller shaft for the purpose of preventing it from revolving, while the toothed wheels are being put in and out of gear.

2. The reduction of friction is effected chiefly by means of a number of anti-friction rollers, *q q q*, which are placed round the shaft in the manner shown in the longitudinal view, fig. 6. These rollers are all placed round the shaft, and are allowed to revolve both on their own axes, and also round the shaft itself. The bearings are provided with proper packings, as at *m m*, to prevent the water from entering the vessel. At *n n*, figs. 4 and 5, there is also a bearing for resisting the horizontal thrust of the propeller shaft when in rapid rotation, which would otherwise quickly wear away the bearings in which the shaft is mounted. This bearing, *n*, is shown detached, and upon an enlarged scale, at figs. 7 and 8; fig. 7 is a view looking from above, and fig. 8 a transverse vertical section. The bearing consists of a metal box, which is firmly screwed to a stationary framing in a convenient manner; a pin, *o*, is screwed through one side of the bearing, and bears against one end of the shaft *c c*, as seen in the figures, and can be tightened up as circumstances may require by merely turning the screw head, whereby the shaft is prevented from wearing away the sides of the other bearings. The metal box *n* is supplied with water until about one-half of the end of the shaft *c* is immersed, as shown in the figure, and then a quantity of oil is poured in, which being the lighter fluid, always floats at the top; a cock, *p*, is placed on one side of the box, exactly opposite to the centre of the shaft, for the purpose of ascertaining the exact level of the two liquids. By constructing the bearing in this manner, and keeping it properly supplied with water and oil, it is kept perfectly cool, as the water in the box abstracts the heat from the working parts, and prevent them from getting overheated.

3. The "novel construction of propellers" is represented in figs. 9 and 10. It consists in mounting any convenient number of perfectly straight blades at an angle round the shaft, in such a manner that the said angle may be varied according to the speed at which the vessel is required to progress. The angle of the blades is regulated by a ring, *b*, which must be firmly connected either to the propeller shaft or to radial arms which carry the propellers. In the figures, the ring *b* is firmly affixed to the propeller

shaft, and the radial arms *d* carry the blades *c* at one end, and at their opposite ends are connected to an additional ring, *z*, which may be moved round on its axis, but is retained in any given position by clamping screws. The arms *d* are also connected to the ring *b*, and are made to turn round on that point, so that, as the ring *z* is moved round on its axis, it either screws in or forces out the outer ends of the said arms *d*, and by that means alters the angle of the blades.

To test the practical worth of these improvements, Mr. Hays has had them applied to an iron vessel, of 176 tons, called the *Experiment*, which was built for him by Messrs. Ditchburn and Mare, and fitted with a rotary engine of 20-horses power, by Mr. Beale. With this vessel a trial voyage was made from London to Cork and back, 26th Feb.—10th March last, full particulars of which Mr. Hays has published in the form of a pamphlet,* entitled "Journal and Observations of a Voyage in the *Experiment*," &c. We quote from this pamphlet Mr. Hays's own estimate of the general results obtained:—

1st. That an auxiliary steam power, in connection with the propeller applied to sailing vessels, is a most effective aid in calms and light winds; but that without some means of making the power *continually* subservient, the expense of the machinery and the space occupied in the vessel with the men for working it, is not sufficiently compensated for.

2ndly. That the differential gearing fully answers all the purposes anticipated, as I found in moderate breezes the excess of speed imparted to the vessel fully equal to that given by the engine in a calm; and in the greatest sailing velocity the speed was increased by half the amount first given.

During the passage to Cork, the wind was favourable from London to the Land's End, and the average sailing speed about 6 to 6½ knots, which was increased by the differential gearing, without any additional consumption of fuel, to an average of 9 knots, or from 40 to 50 per cent.

Crossing the Irish Channel with a heavy head sea, found the original motion of the engine add about 1½ knots to the sailing speed of from 2 to 2½ knots; whereas the second motion of the differential gearing added three knots, increasing the speed, under sail alone, from 2½ knots with about 1½ to 2 points leeway, to 5 knots and a perfectly straight wake.

3rdly. That the slip of propeller was about 30 per cent., and am of opinion the diameter was too small.

4thly. That the oil and water box at the thrust end of the shaft, and the rollers in the stuffing-box, have been the means of keeping the bearings perfectly cool.

5thly. That the rotary engine is well-adapted to the stern propeller; and in my opinion the one fitted in the vessel by Mr. Beale, supplied as effective power as any reciprocating engine of the same nominal power would do; but am unable to form so good a judgment as I could have done had there not been so much slip to the propeller.

The facility of working it gives it a decided advantage.

The upright tubular boiler, fitted by Mr. Beale, gave the utmost satisfaction, as regards either generation of steam, consumption of fuel, facility of producing steam, and consumption of any description of fuel. Coke I found the most satisfactory, requiring no stoking, and of course causing no smoke—a great advantage to a sailing vessel; the quantity of fuel consumed during the voyage averaged about 7 lbs. per horse nominal per hour.

6thly. That vessels using the auxiliary steam power should be constructed on the best principles of sailing vessels, so as to carry their canvass well.

7thly. That the best power for auxiliary aid is as one horse power to about 8 tons builders' measurement, for small vessels; but I am of opinion one horse to from 8 to 10 tons would be sufficient in larger vessels.

Not the slightest vibration or tremulous motion was imparted to the vessel at any time during the voyage.

* Causton, Birchin-lane.

BRITISH PLATE GLASS COMPANY.—EMANCIPATION OF THE GLASS MANUFACTURE.

Sir,—Among the "Notes and Notices" in your last Number (page 191) is an extract from the *Birmingham Journal*, in which it is stated that the "British *Plate Glass Company* relinquished business about two years ago;" but that since the announcement of the Premier's plan of commercial reform they have determined upon immediately resuming operations. This, however, is a mistake; the *Birmingham* Plate Glass Company, and not the *British*, being the party referred to. The works of the latter company are not at Birmingham, but at Ravenhead, in Lancashire, where they have been in successful operation

ever since their first establishment in 1773. This company has long been celebrated for the production of the largest quantity as well as the finest quality of plate glass hitherto manufactured in this country. An interesting account of the works and processes of the British Plate Glass Company is given in Vol. xxvi. of the "Cabinet Cyclopædia." In this work, Dr. Lardner observes, in reference to a desired, rather than an expected, repeal of the duty upon glass, that "whenever this measure shall be accomplished, it can hardly fail to induce such an extension of the manufacture as will prove generally beneficial to the community. The abolition of these duties would be accompanied by the further advantage of removing all those vexatious regulations and restrictions under which the manufacture is now carried on, and which will cease, as a matter of course, when the article is no longer an object of revenue. It is principally owing to these restrictions that so much foreign glass is now brought into this country in the face of what may be considered an amply protecting duty. Foreign manufacturers are allowed to make any and every article out of that quality of glass which will most cheaply and advantageously answer the end, while our own artists are forbidden to form certain objects, except with more costly materials, which pay the higher rates of duty."

Those persons who consider the reduction in price, *minus the duty*, as the principal advantage to be realised by the change about to take place, form a very incorrect estimate of the importance of this measure. The emancipation of the glass manufacture from the vexatious and harassing thraldom of the excise surveillance, will afford free scope for the employment of British capital and the exercise of British ingenuity to an extent of which we can at present hardly form any adequate idea.

The immediate consequence will be to afford constant and profitable employment to thousands of industrious operatives, while the future results will be great improvements in all branches of the glass manufacture, accompanied by a reduction in cost, and in the application of this beautiful fabric to purposes never yet contemplated.

Although other branches of national industry need similar relief, it must be admitted that none have been so fettered, or so much impeded in the march of improvement by fiscal impositions, as that to which relief is in the first instance to be afforded. That Sir Robert Peel may be spared to emancipate them *all*, is the devout wish of—Yours, &c.

W. Baddeley.

29, Alfred-street, Islington, March 17, 1845.

PILBROW'S ATMOSPHERIC RAILWAY.

Sir,—I have to thank your correspondent, E. E., for the information contained in his letter published in your Magazine, of the 22nd ult., which I have not been able to notice till to-day.

In my first communication on this subject, I stated that I thought that sufficient adhesion between plain surfaces for the propulsion of a train of carriages could not be obtained without the sacrifice of other important advantages; and from a consideration of the facts stated by E. E., I think it will be seen that this opinion is not without foundation.

As a substitute for the very objectionable cogged racks and pinions, Mr. Pilbrow proposes to use plain rollers, so placed as to cause a semi-flexible plain bar attached to the piston, to assume in its progress a slightly serpentine form, and thus to obtain adhesion between the rollers and piston bar sufficient for the purposes of traction.

In order to effect this, *three* rollers, *at least*, must be used in the place of *two* cogged pinions. But it is more than doubtful whether an arrangement of three plain rollers, two on one side of the tube, and one intermediately opposite on the other side of the tube, would produce sufficient adhesion for the traction of a train of even moderate weight. Trains vary in weight from 50 to 250 tons, and estimating the force of traction *on a level*, at $\frac{1}{240}$ part of the gross weight to be moved, (which, I believe, is the usual estimate,) it would require an adhesive resistance of half a ton to propel *on a level* a train of the gross weight of 120 tons. But I am willing to take it for granted that a set of three plain rollers at distances of 30 feet apart is sufficient to secure the necessary adhesive resistance; then, as each of these rollers must be furnished with a conical valve,

we shall have *one-third* more surface liable to leakage than before, and considerably more than an increase of one-third in the amount of friction when progressing on a level; but if we are ascending an incline of 1 in 240, we must have *twice* the amount of adhesive resistance, and to obtain it *six* rollers every 30 feet; if an incline of 1 in 120, *three* times the adhesive resistance, and *nine* rollers every 30 feet; and if an incline of 1 in 80, no less than *four* times the adhesive resistance, and twelve rollers every 30 feet; and as a matter of consequence it follows, that in those parts of the line where the greatest propelling power is required, there will exist the greatest amount of surface liable to leakage, and its power-destroying results.

But this is not all: every roller must project more or less into the tube, and must of necessity render the passage of the piston far less air-tight than it would be if the interior of the tube presented a perfectly plain and unbroken surface from end to end.

I differ from Mr. Cheverton in his opinion, that, in the use of cogged pinions and racks, leakage would be prevented on the piston passing the pinions, by the "closing up with a cog in the plane of the piston what otherwise would require to be left as an aperture," for this reason, —that, if the cogs could be made to fit so accurately as to prevent the passage of air, this would require a never-failing perfection of self-adjustment, between the racks and pinions, hopelessly unattainable, where some parts of the machinery are stationary, and occasionally brought into sudden connection with other parts moving with a velocity of 36 ft. or more per second. And it appears to me, that the substitution of plain rollers for cogged pinions will but increase this serious evil; and though there may be more ways than one of *lessening* the difficulty, I think in practice it will be found that, every time the piston passes one of the projecting rollers, a gush of air will pass into the exhausted part of the tube. It is also obvious that the pivots of the rollers will be forcibly pressed against *one* side of their sockets; and as the uneven wear consequent upon this increases, the rollers will be separated, by the pressure of the piston bar, more widely than they should be, and the adhesive resistance proportionately decreased.

It is absolutely necessary, as Mr. Pilbrow, in his specification, shows, that the piston-rack and carriage-rack should maintain the same relative position; that is to say, the piston-rack being precisely under, and matching end to end with the carriage-rack, and, therefore, as long as the power applied continues, and the piston advances, the carriage will do the same to the end of the tube; "neither arriving before or after the other, but together, as they cannot separate, nor can one move or stop without the other." This may be done with cogged racks and pinions, but I ask Mr. Pilbrow, or your correspondent "E. E.," how the same thing is to be effected with plain rollers and bars? How, if sufficient adhesion can thus be obtained for the ordinary purposes of traction, the additional adhesion necessary to prevent the piston-bar being separated from the carriage-bar, and *vice versâ*, when any unusual strain or obstruction occurs, is to be secured without a most fearful loss of power, or the use of something very analogous to cogs?

The models publicly exhibited by Mr. Pilbrow, which work so satisfactorily (apparently), seem to have satisfied "E E." that "the principle is perfectly sound, and its practicability not to be doubted;" but unfortunately, the more I investigate the subject, the stronger are my doubts, and I do not think they will be removed until I see the invention *practically* tested.

Thanking you for the insertion of my former communications,

I am, Sir, yours respectfully,

D. N.

March 14, 1845.

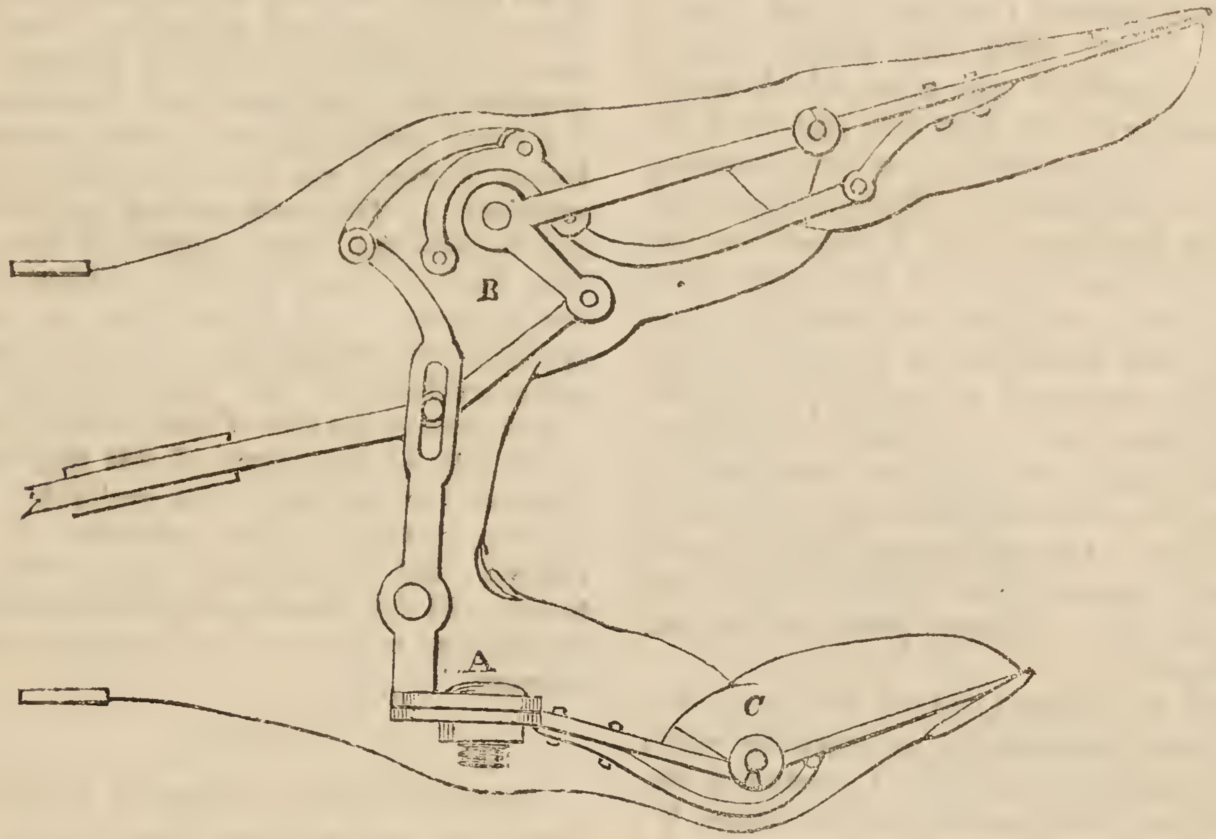
THE ARTIFICIAL HAND—BY SIR GEORGE CAYLEY, BART.

[Continued from page 175.]

In the structures before described a pressure or grasp between the thumb and fingers near their extremities is effected, and also the holding of substances of a moderate size near the middle of the hand; and, perhaps, this may in most cases be as much as is required where the person employing it has only lost one hand, and can, therefore, do any more difficult task with the other; but there are persons who have had the misfortune to lose both hands, in which

case it is desirable to give this substitute all the efficient movements it is capable of. With this view, let the thumb piece, as at A, fig. 5, be furnished with a horizontal joint capable of being screwed firmly against a spring plate, so as to create sufficient friction to prevent its turning with inconvenient freedom, (any required position may also be secured by a spring catch.) By means of this joint the thumb can at any time be turned, as in the natural hand, out of the way of

Fig. 5.



the grasp of the fingers, so that these may close round till they meet the ball of the thumb. This will enable many things to be held more conveniently and firmly than when the thumb meets the extended fingers at some intermediate point, and stops their further progress. To effect this greater range of the joints of the fingers, some little adjustment of the former plan is required. It may be effected many ways, but let the arrangement shown at B, fig. 5, suffice for the present to explain what is intended. And these movements being chiefly similar to those in fig. 4, (marked so in the plate by mistake,) will readily be understood, without further explanation, by reference to that figure. George Douseland can write, though with difficulty, with the hand as constructed in fig. 2, but an inventive young friend of mine has suggested the use of a spring movement in the last joint of the thumb, as at C, fig. 5, which will enable the pen to obey the pressure of the fingers backward in the down strokes; and to propel it forward in the up ones, as the fingers relax their force. This light elasticity of the thumb ceases when pressed back to its natural position by the joint being made incapable of receding further; and, hence, it will be no detriment to the firm grasp between it and the fingers.

To avoid confusion in the figures they are drawn so as to show the movement of one finger only; and in the hand worn by George Douseland there is but one such movement, all the cork fingers being united side by side, and fixed to one broad thin steel plate, jointed, as shown in fig. 2, and covered with continuous leather, only stitched down to mark the distinction of the fingers under it. For common use in most cases this will be sufficient; but where a more expensive apparatus can be afforded, and the appearance of having a real hand is an object, this thin steel plate can be separated into digits, though united at the base as the human hand, and jointed at the proper places in due proportion to each finger; and the tendons piercing these plates, may be either hinged to fixed joints, as at S, fig. 2, or worked from a horizontal extension of the joint H, fig. 4. All the required movements

can be effected by catgut or other tendons attached to the joints of the fingers, as in the natural hand, and terminating in loops or eyes, on different parts of such a hinged bar as F H, fig. 4, so as to give them different ranges of tension to suit their respective purposes. This structure implies the necessity of a counteracting worm, or other spring movement, to extend the fingers and thumb again. Very light and elegant hands may be made on this plan, which would be suitable for the fair sex, and for light work. I before said, the first drawing made of the hand for George Douseland was on this plan; but I found that he could lift the weight of five stone with the stump, and that the strength, precision, and durability of steel joints and tendons was more suitable to his work. These have also the great advantage of giving both extension and contraction, with no counteracting spring to weaken the effect. By one simple, lasting, and efficient means, both these actions are effected with perfect precision in all weathers.

This instrument, in all its forms, has only been represented as working when the spring bolt L, fig. 1, secured the lower arm from turning on the hinge F; but conceive this spring bolt occasionally drawn back, and secured from acting; and that a spring friction plate held the joint F, from turning, with less than three stone weight applied at the ring D by the stump, the grasp of the hand could then be used only up to that extent of pressure, sufficient, say, for example, to lift a can full of liquid; thus, if more than three stone force be applied, the friction of the joint will be overcome, the can will still be retained with the same power, but the movement of the joint will allow it to be lifted to the mouth. This is only one example of a very important principle, applicable to innumerable instances, and which greatly increases the use of the apparatus.

(*To be continued.*)

LIGHTING BY ELECTRICITY.

Mr. Weekes's plan for lighting towns by electricity, which first appeared in the *Mechanics' Magazine*, as far back as June, 1831, and has been since fully developed by him in an article in the *Electrical Magazine* for January last, republished in this Journal of the 12th January, has been lately *re*invented in America, by two persons in Cincinnati, of the names of Mills and Saunders. We extract the following notice of a successful experiment made by them from the *Cincinnati Mechanic*:—

"The apparatus with which the light is made is small, to allow of easy transportation. But it may be increased to an indefinite extent, and with its enlargement is the increase of the size of the light. From our own observation we should suppose the power of the light could not be increased. We never could conceive a light more brilliant. Though but the size of a pea, it is sufficient to illuminate quite a large room, and forbids the steady glance of the eye. The blaze of a candle 20 feet distant from the apparatus, and 3 feet from the wall, cast upon the wall a thick shadow—so much more brilliant is 'the light,' though not one-twentieth the size of the candle's flame. What will be the power of this light when increased to the size of a gaslight? We cannot conceive. The apparatus is not costly; and for lighting Cincinnati, two towers will be considered sufficient to illuminate the whole city, and at a very small expense."

FENN'S SPRING ADJUSTING PLANE.

[Registered under the Act for Protection of Articles of Utility. Joseph Fenn, of Newgate-street, toolmaker, Proprietor.]

We have here another valuable addition to the list of mechanical tools, from the eminent workshop of Fenn, of Newgate-street. Fig. 1, of the prefixed engravings, is a side elevation of this improved plane, partly in section. A is a bed plate for the cutting iron D; B a screwed rod fixed at the back of this bed plate, being passed through bearings *a a*, projecting from the bed plate at top and bottom. C is a traversing nut which works on the shank of the rod B, and has an oblong pin *b*, which protrudes from it into and through a groove which runs down the centre of the bed plate. The cutting iron D is attached to the bed plate by means of the pin *b*, which fits into a corresponding hole in the top of the iron; and as this pin is raised or lowered, by the turning of the screwed rod to the right or left, it raises or lowers the iron. E is the cover of the cutting iron; F is a spring holder, a plan of which is given separately in fig. 2; *f* is the handle of this holder, and *g* the spring at the back; h^1 is the

upper wing, or flap of a pair of hinges, in which the handle terminates at bottom; *i*, a pinching screw, which passes through the upper flap h^1, and presses against the end of the back spring *g*; and h^2 the lower hinge flap, which is secured to the back of the lever E. G is a second spring holder, a sectional plan of which, as seen from the top of the plane, is given separately in fig. 3, which acts against the cover E, and turns on an axis, *k*, which passes across the mouth of

Fig. 1.

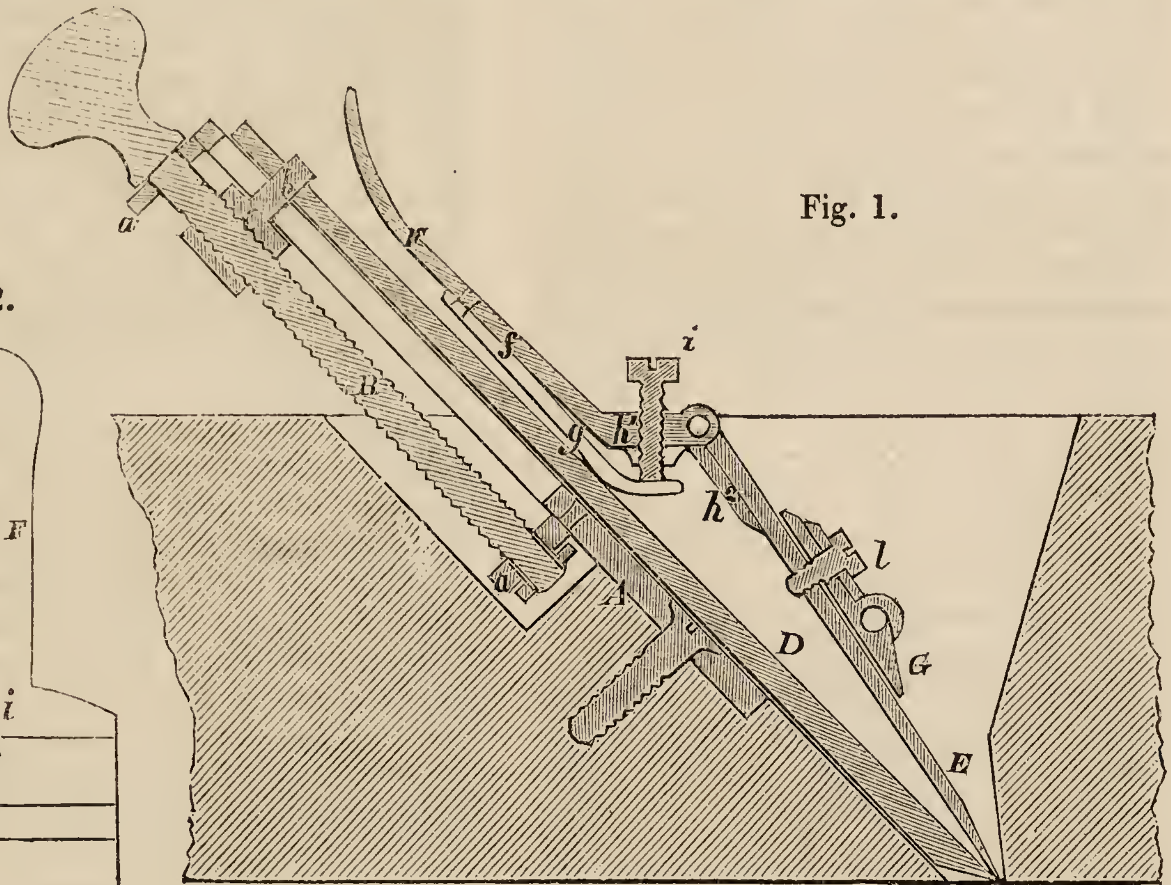


Fig. 2.

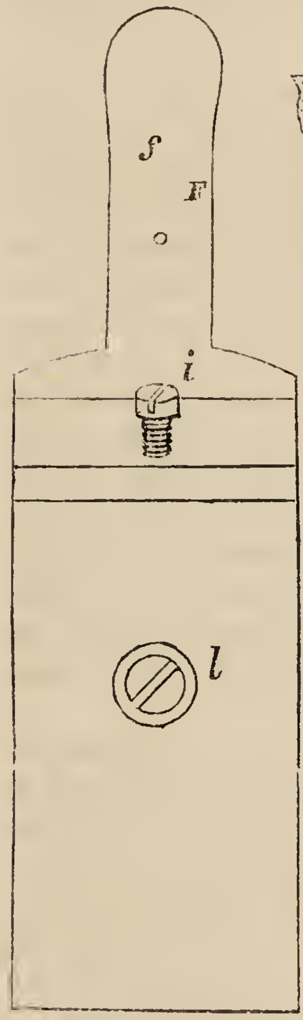
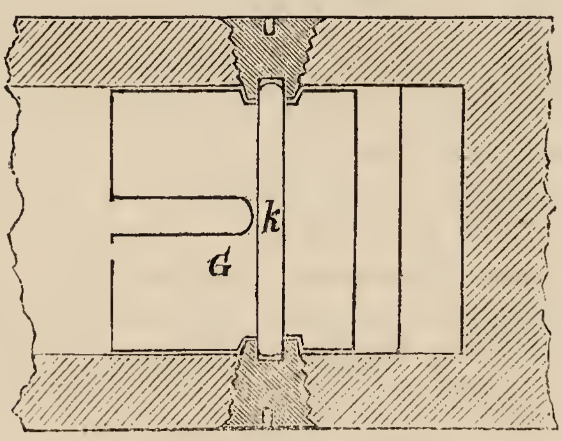


Fig 3



the plane, and rests in screw-bearings in the sides of the wooden body of the plane; *l* is a pinching screw, which is passed through a cleft in the middle of the upper half of this holder, and into and through the cover E. When the spring holder F is pressed down by the handle, the spring *g* and screw *i* serve to keep the cutting iron, D, fast in its place; while, by the same movement, and by the action of the upper hinge flap h^1, the upper end of the cover E is tilted up, so as to bring the point of it into exact proximity with the cutting point of the under iron (as shown in fig. 1); the under iron being kept firm in the position so given to it by means of the second spring holder, G.

ON WARMING AND VENTILATING BUILDINGS—FERMENTATION AND PUTREFACTION—THEORY OF RAIN AND OF ARTIFICIAL LIGHT. BY FRANKLIN COXWORTHY, ESQ., ORDNANCE DEPARTMENT.

Sir,—In my last letter (No. 1106, of Oct. 19, 1844,) on the subject of ventilation, &c. I stated m yintention of putting to the test of experiment the present theory of the diffusion of gases, as having reference to the opinion that spontaneous ventila-

tion is more easily effected in cold than in warm weather, on the principle that the difference of weight in the exterior and interior columns of air increased with the difference of temperature in the interior and exterior of the building, and I think that any result more conclusive on the subject could not possibly be adduced. I have found, as a general result, that when the atmosphere was about the temperature of 50°, the amount of carbonic-acid gas, appreciable in the pit of the theatre of the London Mechanics' Institution, and in the cupola, was about much the same, having obtained a precipitate of 11 or 12 grains of carbonate of baryta to 3,000 cubic inches of air passed through my bottle, it being observed, however, that in the cupola the products of respiration of the whole house were concentrated in the cupola, which was not the case in the pit; and that the amount of precipitate obtained in the cupola increased with the increase of temperature, and decreased as the weather became more cold. But the most remarkable result I obtained, and which certainly by far exceeded my expectation, was on the 13th of December, immediately behind the upper gallery of Drury Lane Theatre, when the pit was quite full, and the remainder of the house about half full; here I passed the same quantity of air through my bottle, and obtained not even an appreciable amount of precipitate. The weather on this occasion was intensely cold. It is clear then, that, *so far as the carbonic-acid gas is concerned*, the cause of ventilation being effected so readily during cold weather is in no way referable to the difference of weight in the interior and exterior columns, but is solely attributable to the existence of the beautiful provision of nature to which I referred in my letter (No. 1102 of Sept. 21, 1844). For proof that vapour, when charged with carbonic-acid gas, undergoes condensation when exposed to a cold atmosphere, I need only refer, to the steam as it issues from the funnel of a locomotive engine. On the Greenwich line I have invariably observed that the steam no sooner quits the funnel than it immediately descends over the parapet of the line, and continues descending until it reaches the earth. Now here the temperature of the vapour is infinitely above that of the lungs, and still it never has an upward direction, unless the atmosphere be very warm, and then only for a short time.

In support of the doctrine of the diffusion of gases, great importance is attached to Graham's bottle experiment, but which, with all deference to that great experimentalist, I consider as no proof whatever, in consequence of the pressure of the atmosphere, on which specific gravity depends, being entirely cut off. If the smallest possible hole were made in the bottom of the two bottles, it is unquestionable that the hydrogen would ascend, and the carbonic acid descend, however intimately these two gases might be mixed. If a bladder be filled with an admixture of hydrogen and carbonic-acid gas, it is well known that the whole of the hydrogen will fly off and leave the other gas behind, and if either of these gases be passed into a vessel, agreeably to their specific gravities, the whole of the air previously in the vessel will be driven out, and the gas will occupy the entire space; how is it, then, I ask, that the law of diffusion does not in the one case prevent the escape of the hydrogen, and in the other cause an admixture of the hydrogen or carbonic acid with the air in the vessel? In fact, Graham's own experiment of the tube with a plaster cap explains the cause—at all events, so far as the hydrogen is concerned.

Even supposing the present theory to be correct, the propriety of adopting it becomes very questionable. All medical men are agreed in the propriety of keeping the feet warm and the head cool, whereas, the cold air introduced at the bottom of the apartment, cannot by any possibility ascend until it shall have robbed the lower extremities of the body of sufficient heat to raise its temperature above that of the external air, so that, whilst the feet and legs are constantly as cold as if they were surrounded with ice, the air never reaches the lungs but in a heated vitiated state, which is, I believe, immediately the reverse of what should be. That great difficulty will be at all times experienced, in maintaining the purity of the atmosphere of a crowded room by *spontaneous* ventilation, must be admitted, but it appears to me, that if the air were admitted into the room, in such manner as in no way to impede the motions of the gases, as they escape from the lungs, agreeably to their specific gravities, much

benefit would be derived therefrom, and in fact, practice shows that this is the best possible system of ventilation; for when the temperature of the atmosphere is low, and the condensation of the vapour and carbonic-acid pretty rapid, the cold air not rising sufficiently fast to supply the partial vacuum, there is a constant rush of air downwards, and so great is this descent from the cupola of the theatre of the London Mechanics' Institution, that it became absolutely necessary on the 5th of February to remove the line to which I suspended my bottle, to allow of the windows being entirely closed.

When, however, I commenced this correspondence, (No. 1098, Aug. 24, 1844,) it was not with the view of at present agitating the question of spontaneous ventilation, but to introduce, as I conceived, a cheap and efficacious means of warming and ventilating apartments, particularly offices, at that time of the year, when, *from the temperature of the external atmosphere, cold air cannot be admitted into the room*, and that I am not altogether singular in preferring the downward to the upward current, I may remark, that on reference to the last number of the Royal Engineer Papers, it will be seen that Major Jebb, the Inspector General of Military Prisons, introduces the pure warm air at the top of the cell, and draws off the foul air at the bottom, and the same method is followed by Messrs. Haden, of Trowbridge, a plan they have doubtless adopted for the obvious reason, that man's respiratory organs are turned downwards, and were not intended by nature as receptacles for dust. But by respiration, atmospheric air, a compound of one of oxygen to four of nitrogen, is taken into the lungs, and oxygen, nitrogen, and carbonic-acid gas are expelled, and as carbonic-acid gas occupies the same space as the oxygen consumed, it is quite clear, that for every volume of carbonic-acid gas generated, four volumes of nitrogen must also be liberated into the room, supposing none of it to be consumed, and as this gas is as fatal to respiration as carbonic-acid gas, unless it be also got rid of, the ventilation must be very imperfect.

It is also a question of vital importance, and which has yet to be decided, whether any and what portion of the nitrogen of the air is consumed during the process of respiration. Liebig asserts, and his assertion has gone the round of the philosophical press, that a portion of the oxygen of the air taken into the lungs during respiration combines with the hydrogen of the food and forms the vapour given off by perspiration. Whatever might be my own opinion on this question, (for after all this *can* be but matter of opinion,) I should be doubtful of its correctness when opposed to that of such a man as Liebig; and I should hesitate in now agitating the question, were it not that this great philosopher had long since proved that such a process as this is at variance with the provisions and wisdom of nature. He has shown that ammonia is essential to vegetation; and nature, we know, never creates a necessity without providing for it. And to what source are we to trace the production of ammonia but to the hydrogen of organic matter? That hydrogen has a greater affinity for oxygen than any other substance under the influence of combustion or the electric spark, there cannot be a question; but unless I am most egregiously deceived, hydrogen never does combine with oxygen *to form vapour* under the influence of negative electricity. Some years since, I made many experiments on the decomposition of organic matter, particularly animal, in order to determine what action air had on it during the process of putrefaction. For this purpose, I made use of a copper still, to the feeder of which I connected a pipe that went to the bottom of the still, and to the top of the still I connected a stop-cock. Having partly filled the still with human secretions, (mixed with water) which I had previously washed with dilute hydrochloric acid to deprive them of all the ammonia, I luted on the top, and left the still quiet for two or three days for the process to go on. I found as a general result that putrefaction was more rapid when the vessel was in connection with the earth than if insulated; and that the process was still more rapid if the still were immersed in the earth. The gases which I drew off at first consisted principally of sulphuretted hydrogen and carburetted hydrogen and the components of the air. And after the process had gone on for some time ammonia and carbonic acid were amongst the gaseous compounds in abundant pro-

portions, and with these latter bodies the water in the still was highly charged as well as with sulphuretted hydrogen. About the same time that I was engaged in these experiments a cesspit was emptied in the yard adjoining to my own, and the weather being then very hot and what is termed sultry, the stench that arose from it became unbearable. With a view to get rid of the nuisance, as well as to form some idea of the amount of the hydrogen compounds that were being generated, I mixed together the proper proportions of manganese and salt in an old jug and placed on the top of the mixture a cup full of dilute sulphuric acid. And when I had lowered the jug to the bottom of the pit, I upset the acid by pulling a string previously attached to the handle of the cup. I had no sooner done this than the whole yard became filled to the second floor windows with a dense white smoke, which continued issuing ftom the pit for at least fifteen or twenty minutes in large volumes, and was still perceptible the next day. Now if the hydrogen of matter under the influence of putrefaction, or a negative state of electricity, possessed the same affinity for oxygen that it has during combustion or the formation of chlorine by the decomposition of hydrochloric acid, it is quite clear that none of these compounds could be formed, as the whole of the hydrogen would be converted into vapour; and it is equally evident that as the source from which the animal kingdom derives its food contains no ammonia and but little nitrogen, that the greater part of the nitrogen that enters into the composition of the ammonia, must be obtained from the atmosphere, either during the process of respiration or putrefaction, but more probably both. And I suspect that if Liebig had stated that a portion of the nitrogen taken into the lungs during respiration enters into combination with the hydrogen of our food and forms the ammonia that escapes from our system with respiration, he would have been much nearer the truth than in making the assertion he has.

During the decomposition of animal matter there is liberated carbonic-acid gas, ammonia, carburetted, phosphuretted, and sulphuretted hydrogen. Carbonic-acid is given off from the lungs of animals by respiration; ammonia escapes through the pores of the skin with perspiration, and is contained in great quantities in animal secretions, as well as sulphuretted, carburetted and phosphuretted hydrogen, the decomposition in both cases taking place under the influence of negative electricity.

In the July Number, of 1840, of Dr. Silliman's Journal, is published a most interesting account illustrative of the vast quantity of carburetted hydrogen that is generated during the decomposition of vegetable matter in water.

After describing the circumstances that induced the writer of the article to collect and burn some gas that escaped from a pond in which the students of West Town boarding school, Chester Co., Penn., were in the habit of bathing, he observes that he was induced to get the boys to bathe in the evening, and told them that he was going to set the pond afire, and that "the usual preparation for bathing being made, some fifty of the less timid entered the water with the injunction to step as lightly as possible till the pond was discovered to be on fire, when all would be at liberty to proceed as would best suit their inclinations. We soon came to a favourable spot, and the gas beginning to come up pretty freely a lighted taper was brought near the surface, when in an instant a lambent flame played upon our unprotected bodies, and cast a gloomy light upon the surrounding forest, disclosing here and there, amid the thick underbrush, the pale faces of their shouting companions who remained upon the bank. In the hurry, the injunction to step lightly was forgotten, and the general stir of the leaves which took place extricated the gas in such abundance that the flame rose several feet above our heads. As they separated from me I raised my feet from the bottom, and found it much more difficult to suppress my laughter than to extinguish the flames."

M. Boussingault, in a very elaborate paper read before the Academy of Sciences on the 4th of August, 1834, details a great number of experiments which he made within the tropics in order to determine the presence of malaria (miasma) in the atmosphere, and gives as a general result of his labours that one part of air contains, taking an average

of his experiments, 0·000005 by weight, and 0·00008 by volume of hydrogen, which result, taking into consideration that it was arrived at by burning the air in a tube, and determining the increase of weight by vapour, cannot be regarded as at all conclusive; and this opinion he appears also to have entertained, for at the conclusion he states, that the question of whether or no hydrogen be a constituent part of the atmosphere, will soon be solved, for he intends to take his instruments on some of the summits of the Alps and Pyrenees; but upon what grounds he anticipates more favourable results there than in the neighbourhood of the swamp where he experimented does not appear.

M. Boussingault states, that carburetted hydrogen is always produced by the decomposition of vegetable matter, and arises from all swamps, and, therefore, the quantity liberated from the surface of the earth must be very considerable; that it is produced in the greatest abundance under geological circumstances as yet but little known; that near the lakes of Canada there are several burning springs, and in some parts of the United States, this gas escapes from the earth in such abundance as to be applied to domestic purposes; that Italy and Sicily also possess numerous springs of burning gas, but that it is in Asia where this gas escapes in really prodigious quantities, and that M. Imbert states in a letter to M. Humboldt, that having set fire to a stream of gas which escaped from the earth, it produced a flame 2 feet high by 1 foot in diameter.

The reasoning of M. Boussingault's paper is, throughout, based on the doctrine of the diffusion of gases; he supposes that the atmosphere is purified of this gas by electric agency, and states, "an observer placed at the equator, *if possessed of organs sufficiently acute*, would continually hear the noise of thunder."

Upon what grounds this law of the diffusion of gases is based, I am altogether at a loss to understand, since we know of no one phenomenon in nature that bears the theory out. Not only may we fill vessels by displacement, but we know also that certain caves contain carbonic-acid gas to a certain height only, and that a man descending into a well containing carbonic-acid gas meets with it always at the bottom. If a vessel be filled with carburetted hydrogen, such as a balloon, not only is the weight of the structure overcome, but also a number of individuals equal in weight to that of the difference by displacement in weight of the gas and the atmosphere, are taken up. Now the gas contained in the balloon is but the collection of a certain number of globules, each of which has a comparative specific gravity to the whole mass, and therefore must ascend as it escapes from the balloon, at a rate proportionate to the loss of weight from which it is disengaged, until it reach the exterior of the atmosphere. Let an individual place himself on his back, as when in bed, and cover himself over with clothes, so that they form an inclined plane from the feet to the head, and then place a bladder of gas near the feet, of an admixture of hydrogen and carburetted hydrogen contaminated, so as to be sensible to the nasal organs, and matters being so arranged, press out the gas; the sense of smell will afford immediate evidence that a portion of the gas escapes at the top of the clothes; but if, instead of keeping the legs straight, the knees be bent so as to form a triangle, and the gas be allowed to escape, either at the feet or the hip, no smell whatever will be perceptible, as the whole of it will escape at the knees, that part being the highest.

The most instructive fact that has for a long time been published on the decomposition of organic matter is that described by Professor Botterill, in his paper on the subject of fermentation, published in your Number of the 21st of December last; and the lucid manner in which the Professor has treated the subject, is highly calculated to throw much light on organic chemistry.

There is, however, one point on which the experiments I have made lead me to a very different conclusion to that which he has arrived at. In paragraph 6 of his Memoir, he states that when an electro-chemical decomposition is in actual operation, *the laws of nature will be obeyed;* if there be not sufficient oxygen in the compound to meet the contingency or demand of the nitrogen or carbon, then *it must undoubtedly be taken from the water, and by doing that it sets free more hydrogen than is required in a*

proper electrical action, and more than ought to be set at liberty.

Now sugar, the substance that undergoes fermentation, is a compound of 8 hydrogen, 28 carbon, and 64 oxygen. If it be subjected to the action of sulphuric acid, the oxygen and hydrogen enter into combination and form water, and the carbon is set free; if under the influence of a healthy fermentation it is resolved into carbonic-acid gas and alcohol; but if communication with the atmosphere be cut off, the vinous fermentation ceases, and carburetted hydrogen is liberated. The action of the sulphuric acid on the sugar is ascribed to the affinity the acid has for water, and all lecturers whom I have ever heard on the subject, to remove all difficulty, at once say that sugar is a compound of water and carbon, and that the acid abstracts the water and leaves the carbon behind; but our senses tell us that this is not the constitution of sugar, and if it were, the acid would act more energetically on the sugar in a dry state, than if previously mixed with water, whereas we know that water is indispensable to the action. If to the prime conductor of an electrifying machine a candle be approached, the flame is drawn towards the machine, and the spark obtained from the machine is sensibly diminished, and when the hydro-electric machine at the Polytechnic Institution is in operation, the direction of the electric current is towards the machine. Here, then, we have positive evidence, that in the formation of water and carbonic acid gas, electricity is abstracted from the air, and the action of the galvanic battery affords undeniable proof, that by the decomposition of water electricity is liberated to the air. Water, then, contains electricity in great abundance, and if it be mixed with sulphuric acid, an amount of heat is given off far greater than we are enabled to account for, from the contraction of the two liquids; and whenever oxygen and hydrogen are subjected to the action of free electricity, they invariably combine and form water. When, therefore, syrup is subjected to the action of strong sulphuric acid, the electricity which the water of the syrup contains is expelled, and causes the combination of the hydrogen and oxygen of the sugar to form water, and the carbon is set free.

Under the influence of a less energetic electric principle, such as that induced by fermentation, the oxygen and hydrogen appear to require the presence of a third element to effect their combination, and we then have the formation of alcohol, a compound of oxygen, hydrogen, and carbon; but if, by cutting off the communication with the external air, the electric state be still further reduced, the putrefactive system commences, and hydrogen no longer combines with oxygen, but with carbon, and we have formed carbonic-acid gas and carburetted hydrogen; and as there is not in the constitution of sugar sufficient oxygen and hydrogen to convert the whole of the carbon into carbonic-acid gas and carburetted hydrogen, if the process were continued till all action ceased, a portion of the carbon would unquestionably be set free in the menstruum.

Water, I maintain, under the influence of putrefaction or negative electricity, is never either decomposed or formed; it is not, therefore, the grand resolvent of organic matter, as observed by Dr. Ure, in his Dictionary of Chemistry, article Putrefaction. That it disintegrates organic matter, and thereby exposes it to the action of air, containing a greater quantity of oxygen than enters into the constitution of the atmosphere, and thereby facilitates its decomposition, there cannot be a question; but if it did more than this, it must be evident that vegetable matter in water, like that in the earth, would undergo entire decomposition, which we know it does not; and putting soups, meats, and other articles of food into tin cases for their preservation, would avail but little, particularly in warm climates, since electricity cannot be wanting, the tin being a good conductor.

I need scarcely remark, that at the time of my making the experiments referred to, my mind became forcibly impressed with the simple and beautiful manner in which nature had placed, beyond even the most remote chance, the certainty of the fulfilment of her purpose. If, under the influence of combustion, hydrogen had a less affinity for oxygen than has carbon, it is quite clear that the whole of that valuable gas for the generation of heat would escape into the atmosphere; whereas, if during putrefaction or fermentation, hydrogen had

a greater affinity for oxygen than for either carbon or nitrogen, the formation of carbonic acid and ammonia would be left to chance, which is not consonant with nature's laws,—and it is difficult to comprehend why, in accordance with the nascent theory, during the fermentation of sugar, the elements that enter into the constitution of that compound, do not resolve themselves into water and carbon instead of carbonic acid and alcohol, since, during the formation of chlorine, the oxygen disengaged from the manganese has sufficient affinity for the hydrogen of the hydro-chloric acid to detach it from the chlorine with which it is in combination, whilst these phenomena are perfectly reconcilable to the different affinity of hydrogen for oxygen under different states of electricity.

A difficulty, however, presented itself which, at the time of my making my experiments, appeared insurmountable, it being evident that an immense quantity of gas must constantly be escaping from the earth, the restoration of which appeared to me impossible; although carbonic acid, from its specific gravity and affinity for water, would have a tendency to descend to the earth, and ammonia, if it escaped, would assuredly be brought back by rain and dew, I could not see in what manner the loss of the light carburetted hydrogen, generated during the decomposition of organic matter, particularly the vegetable, was prevented, that gas being excessively light, and not in the slightest degree absorbable by water. I therefore left to time and reflection the solution of that which I was then unable to comprehend, and I think that now I shall have no difficulty in showing how beautifully this great object is accomplished by nature, and in explaining several other phenomena in no way to be accounted for with our present notions of the formation of rain and the generally received doctrine of the diffusion of gases; and, that I may be the better understood, I will first endeavour to show what are the phenomena at variance with our present notions.

A fall of rain is invariably accompanied by, or proceeds from, a densely black cloud, which cloud continues floating about in the atmosphere long after the fall of rain, and *gradually* changes colour from black to white, and ultimately disappears; whilst steam, (as commonly understood,) whether viewed by reflected or transmitted light, is *never black* but *always white*, does not retain its partially condensed form, but is either absorbed by the atmosphere or condensed into very large drops immediately on its first condensation.

The clouds are blacker, and the fall of rain is more rapid during thunder storms than at any other period; but we are at a loss to comprehend why free or positive electricity should cause, or be generated by, the condensation of vapour, or give to that vapour a darker appearance.

Again, before the fall of rain, in calm weather, the sky becomes overcast at a height infinitely above the tops of the highest mountains, the summits of which are much *above the point of eternal frost* in the atmosphere, and are ever covered with snow. But we cannot understand how vapour can ever reach such a height in the atmosphere; and furthermore, that clothes, when wet, dry nearly as fast during frosty weather as in the hottest day in the summer.

For some days before the fall of rain, the atmosphere becomes specifically lighter, as is evident from the fall of the mercury in the barometer; and although we may conceive the atmosphere at its furthermost limits to be in the form of waves, still there is nothing to induce us to imagine why it should be at a greater height during fine than during rainy weather; and certainly the circumstance of its being surcharged with vapour ought not to reduce its specific gravity. And we are equally at a loss to comprehend why, from the atmosphere being charged with vapour, organic matter should undergo more rapid decomposition than during fine weather. But that this is fact is evident from the great stench that arises from drains, and other places of the like description, for some time before the fall of rain.

In tropical climes the rains are periodical, so much so that preparation is made for them in the East Indies a day or two before their commencement; although at the time of making such preparation not the least appearance of rain is perceptible, which certainly cannot in the least be accounted for on the existing theory.

(*To be continued.*)

THE "RATTLER" SCREW EXPERIMENTS.

The *Rattler* has returned to Woolwich from her sea-going trial with the *Victoria and Albert* and *Black Eagle* yachts. We are sorry to learn that the general result of this trial has been by no means satisfactory; and that for the present there is *a pause* at head-quarters as to the propriety of fitting steamers destined for deep sea, as well as river service, with the screw. In smooth water, with an even keel, the screw of the *Rattler* performed better than the paddle-wheels of the competing vessels; but when the vessel had to contend against a high wind and strong head sea, the screw was almost powerless. The area of the blades is now supposed to have been reduced too much, and a new propeller has been ordered to be made with blades considerably enlarged towards their outer extremities. In the meanwhile it has been determined to send the *Rattler*, as she is, on another trial into the North Sea, in company with the *Alecto* paddle-wheel steamer. The *Alecto* is a vessel which has just returned from the Mediterranean, after five years' service, with her engines and boiler all in a very wretched, if not unserviceable, condition. Is there no better steamer than this at hand to send on such a prize match as this? It will be doing neither the screw nor the paddle-wheel justice to give the *Rattler* such a competitor as the *Alecto*. Should the *Rattler* beat the *Alecto*—which, if the weather happen to be fair, she very well may—she will not by that retrieve the laurels she has lost in her trial with the better-appointed *Victoria and Albert* and *Black Eagle;* and, on the other hand, should the *Alecto*, cripple as she is, win the day, a "heavier blow and greater discouragement" will be given to screw-propelling than it may really deserve. We hope their lordships will reconsider this matter, and either replace the *Alecto* by a steamer in good working order, or suspend all further experiment till the new screw is ready.

EXPERIMENTAL TRIAL OF HER MAJESTY'S STEAM FRIGATE "SCOURGE."

On Tuesday last, the *Scourge*, Government steamer, was tried down the river: she has been fitted by Messrs. Maudslay and Field, with a pair of their double cylinder engines, each engine of the power of 210-horses. The cylinders are 54 in. diameter, and the length of stroke is 6 feet. The vessel will draw at her load line 13 ft. 6 in., but when tried she had nothing on board except the jury-mast rigging, under which she came round from Portsmouth, and drew only 11·3 mean, (10·2 forward, 12 ft. aft.) The paddles had a dip of only 2·4, in consequence of which the engines went very much beyond their proper speed, making twenty-three and twenty-four revolutions, and this they did with the throttle valves full open, without using the expansive gear,—the steam blowing off. The perfect ease and steadiness with which these large engines worked at this high velocity, the piston travelling 288 feet per minute, and with the full power on, was very remarkable, and speaks volumes in favour of direct-acting engines and long connecting rods. The speed was ascertained in Long Reach to be 11 knots, or 12¾ miles per hour. The vessel is fitted with tubular boilers.

THE ACCIDENT AT MR. SAMUDA'S MANUFACTORY.

The Inquest on the bodies of the persons killed by the late deplorable accident was concluded at a late hour on Thursday afternoon, when the jury returned a verdict of "Manslaughter against George Lowe," accompanied with some strong observations on the "inefficiency generally of the machinery" at Mr. Samuda's works. We shall give full particulars in our next.

NOTES AND NOTICES.

How to extinguish Fire in a Chimney.—A gentleman was, a day or two since, about to sit down to dinner with a few friends, when the dining-room chimney accidentally caught fire, roared tremendously, and assumed a very alarming appearance, the flames bursting out in volumes from the chimney-top. It was fortunately recollected that salt had been recommended in this journal as an effectual remedy in such an emergency. The salt-jar was instantly taken down, and about a quart of its contents was at once thrown upon the fire. The effect was as wonderful as it was instantaneous. In a few seconds the fire was totally extinguished. *Salisbury Journal.*

The Albata Metal.—To electricity we are indebted for some very valuable discoveries in the purification of metals during fusion. I will repeat the experiment by again passing the current of electricity. You perceive how instantaneously the pure and the impure particles are separated. This is accounted for by what I have just explained as to positive and negative attraction. But it is not only for the purification of metals that electricity is a powerful and mysterious agent in the hands of science; it extends to their atomic combinations also. This was discovered about eight years since by Mr. Watson, of London; and to it the world is indebted for his simulated silver, called "Albata" (argent de Londres, désigné par le nom de Albata.) No patent was taken out for this process, as the specification would have declared the method to competitors; but it has been kept a profound secret, and a large fortune is being realized by the inventor, through the manufacture of every article formerly made only of silver. I consider it possible that the efforts of the alchymists of old will at last be perfected through the aid of electricity. It was not in the proportions that they failed, but in the means of purification, and the perfect combination of the atoms.—*Mons. de Bonneville's Lectures, Academie des Arts à Paris.*

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